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(54) Title: METHOD AND SYSTEM FOR DIRECT SERVER SYNCHRONIZATION WITH A COMPUTING DEVICE
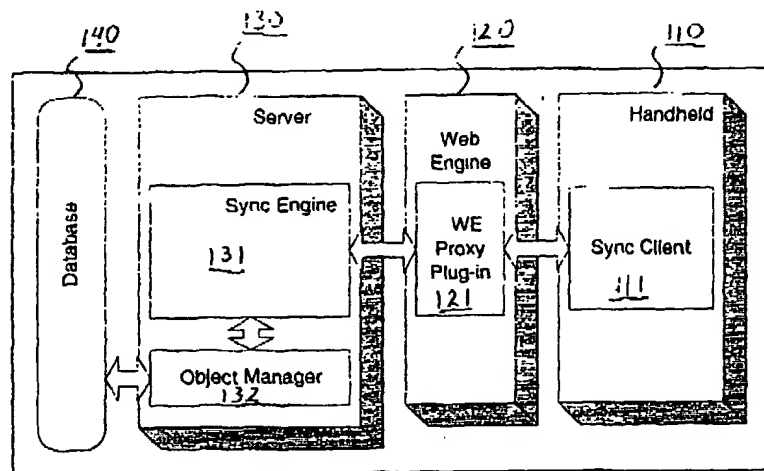
(57) Abstract: A method and system for direct server synchronization (100) with a computing device is disclosed. In one embodiment, the method comprises synchronizing directly a handheld device (110) and an enterprise server (130), which comprises retrieving a record extraction sequence from the server; and extracting records stored on a database according to the record extraction sequence, wherein the extracted records are not already stored on the computing device.

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METHOD AND SYSTEM FOR DIRECT SERVER SYNCHRONIZATION WITH A COMPUTING DEVICE

FIELD OF THE INVENTION

[0001]   This invention relates to computer systems, and more specifically to a method and system for direct server synchronization with a computing device.

BACKGROUND OF THE INVENTION

[0002]   Palm or handheld computers have offered very limited functionality and have been restricted to being personal organizers. These watered-down computers are not compatible with programs on larger desktop and notebook computers, but rely on proprietary operating systems and programs to ensure small memory footprint and quick response time, even on low-power microprocessors. These restrictions have limited the usefulness of the personal organizers, as they operate stand alone and cannot readily share data with other computers.

[0003]   Some handheld devices are capable of interacting with enterprise business applications running remotely on enterprise servers via a network, such as the internet. The two platforms were linked via one or more communication paths usually through a host server, including paths through a modem, a parallel port, a serial port, or a cradle assembly. Further, various wireless communication techniques, such as radio or infrared communication may be used. In the event that a cradle was used, when the handheld computer was in the cradle and actively connected to the host computer, the handheld computer typically entered a mode to update data in the host computer and itself.

[0004]   A major problem exists in the current methods of synchronizing data between the enterprise server and the palmtop or handheld computer. For instance, certain data such as calendar information, appointment information, and notes, among others, would generally be kept on the server, which may be networked so that other handhelds or workstations may remotely update the calendar information, appointment information, and notes. The same information was also kept on the palmtop or handheld computer for the user to review and update when mobile. However, if the user was traveling and information was entered on the server or on a remote station on a network server machine while the user was not at his or her office, or if the user entered information on the local version of the data in the palmtop or handheld computer, the information contained in the server and the

palmtop or handheld computer would become non-coherent, leading to undesirable problems such as meeting conflicts and miscommunications.

[0005]   Prior art methods synchronize a list of records, such as contact and appointments. They are not shared among different users and/or user accounts and only visible to the owner and can only be modified buy the owner.

[0006]   Some enterprise applications can handle very complex data for enterprises targeted for different areas, such as Field Service and Sales Force Automation, and more. The data models in applications are much more rich than those which can be represented by list of records. Plus, the data may have the following visibilities:

1)   Visible only to particular person,

2)   Visible only to a particular position (each person may have one or more positions in an organization),

3)   Visible to a group of persons, such the persons in the same sales team, or in the same account team,

4)   Visible to management positions,

5)   Visible to a particular organization in a company,

6)   Visible across all organizations in a company.

[0007]   The change in the visibility of a particular piece of data leads to the changes of the scope of people who can see and change it. If more than one person can change it, the prior art methods of synchronization failed to keep the data coherency among all the persons who can see and modify it.

[0008]   The prior resolutions of the data synchronization problem were generally very time consuming and tedious and therefore reduced the effectiveness of the palmtop/desktop combination. One solution was to limit the accessibility of files such that only files physically residing with the user were the master. However, this solution dictated that no changes could be made to the other system without the danger of losing those changes. Thus, while the palmtop/desktop combination of computers existed, the use of the combination was not popular due to the requirement that the user had to manually synchronize the data on both platforms. Therefore, the problem of synchronization limited the potential of the palmtop or handheld computer market.

[0009]   One problem encountered by the current generation of handheld devices and their add-on connectivity solutions is that the connectivity solutions rely on batch mode rather than real-time oriented approaches to data coherency. Because the server and the

handheld device typically became disconnected and incommunicado when the user goes mobile, the data synchronization problem becomes intractable. During the mobile period, the creation, the deletion and the modification of data causes incoherency that often results in conflicts reconcilable only through manual intervention by the user. These conflicts would arise because the server and handheld device were unable to communicate changes in their data until they were reconnected using a serial, parallel or modem connection.

SUMMARY OF THE INVENTION

[0010]   In one embodiment, the method comprises synchronizing directly a computing device and an enterprise server, which comprises retrieving a record extraction sequence from the server; and extracting records stored on a database according to the record extraction sequence, wherein the extracted records are not already stored on the computing device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]   The accompanying drawings, which are included as part of the present specification, illustrate the presently preferred embodiment of the present invention and together with the general description given above and the detailed description of the preferred embodiment given below serve to explain and teach the principles of the present invention.

[0012]   Figure 1 illustrates a block diagram of a direct server synchronization system 100.

[0013]   Figures 2A and 2B illustrate an exemplary flow diagram of the data exchange between handheld 110 and server 130 via web engine 120 for direct server 130 ·synchronization.

[0014]   Figure 3 illustrates a computer system 300 representing an integrated multi-processor, in which elements of the present invention may be implemented.

DETAILED DESCRIPTION

[0015]   A method and system for direct server synchronization with a handheld device is disclosed. In one embodiment, the method comprises synchronizing directly a handheld device and an enterprise server, which comprises retrieving a record extraction

sequence from the server; and extracting records stored on a database according to the record extraction sequence, wherein the extracted records are not already stored on the handheld device.

[0016]   In the following description, for purposes of explanation, specific nomenclature is set forth to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that these specific details are not required in order to practice the present invention.

[0017]   Some portions of the detailed descriptions which follow are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0018]   It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussion, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0019]   The present invention also relates to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs),

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random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus.

[0020]   The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description below. In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the invention as described herein.

[0021]   **Figure 1** illustrates a block diagram of a direct server synchronization system 100. System 100 includes handheld device 110. The present method and system is not limited to handheld device 110. It may be applied for the direct server synchronization of computing machines, like personal computers and laptops as well. Handheld 110 could be a Palm™ operating system device such as those manufactured by Palm, Inc. of Santa Clara, California, or a Microsoft CE™ operating system device, such as those manufactured by Casio, Inc. of Dover, New Jersey, or similar Palm and CE devices. Included in handheld 110 is synchronization client 111 (Sync Client). Sync client 111

a)   provides a user with a synchronization interface ;

b)   interfaces with modules, such as a handheld database generator, a handheld transaction manager, and a data integrity manager;

c)   completely rollsback transactions after the previous synchronization;

d)   imports the net changes downloaded to handheld 110 so that the local data model on sync client 111 reaches the same state as that of database 140;

e)   sends log off requests to server 130;

f)   sends a request to server 130 for a device ID if it is the first time handheld 110 is synchronized with a server 130;

g)   sends its device ID to server 130 if it has previously synchronized with server 130; and

h)   sends a request to server 130 to download application definitions (meta-data) if it is the first synchronization, there are meta-data updates caused by responsibility changes, server 130 upgrades the application with new meta-data, or meta-data is missing on sync client 111.

[0022]   Each device 110 synchronizing with a server 130 hosting an enterprise application has a unique ID. Server 130 uses the device ID to determine performance requirements, security and licensing management.

[0023]   Web Engine (WE) 120 is coupled to handheld 110. WE 121 includes a WE proxy plug-in 121. Plug-in 121 is a Hyper Text Transport Protocol (HTTP) extension which translates HTTP requests to a different networking protocol, such as SISNAPI. SISNAPI is a protocol operating on top of TCP/IP, which is similar to HTTP, but provides additional performance in data transport, security, and scalability.

[0024]   Server 130 is connected to WE 120 and may be an enterprise server running enterprise applications or similar server. Server 130 includes a synchronization engine 131 (Sync Engine) which communicates with plug-in 121. Sync Engine 131

      a)   handles requests for logging-in and logging-out from sync client 111,

      b)   uploads transactions from handheld 110 and processes those transactions;

      c)   extracts records for business components from database 140;

      d)   packs and sends records to handheld 110;

      e)   generates a digital signature for checking synchronization integrity; and

      f)   Finds the net changes of the sync client 111 based on its synchronization history.

[0025]   Sync Engine 131 includes a server sync manager (SSM). SSM is comprised of many sub-managers, including a transaction processing manager, a report manager, a data extraction manager, a transaction history manager (THM), a user profile manager (UPM), a conflict resolution manager (CRM), a meta-data sync manager (MSM), and a sync visibility manager (SVM).

[0026]   The transaction processing manager parses the transactions sent from SSM and executes the transactions one-by-one. The report manager reports conflicts, transaction errors, and synchronization results. The data extraction manager accepts requests for extracting raw data, and packs the data into a text file in the form of an object. The object is defined by a universal object locator which uniquely identifies each object.

[0027]   The data extraction manager manages the integrity and consistency of synchronized raw data. THM stores a transaction history and compares the results for each sync session. THM stores the results and works with the report manager and data extraction manager.

[0028]   UPM manages user profiles, such as usernames, application names, device, object manager names, and sync-filters used by the user. CRM cooperates with report manager and the transaction processing manager to ask for feedback and confirmation when conflicts occur.

[0029]   MSM extracts meta-data (such as screen, view, and field definitions) and packs the meta-data into a XML format. The meta-data is stored locally in server 130. Additionally, MSM monitors the consistency and integrity of meta-data between server 130 and handheld 110. MSM supports repository upgrades, and monitor's responsibility changes that lead to meta-data updates.

[0030]   The SVM applies rules for cutting down the amount of data synchronized between server 130 and handheld 110.

[0031]   Server 130 also includes object manager 132 which loads objects in and out of database 140. Also included in system 100 is database 140. Database 140 may be a relational database, such as an Oracle ^{TM} database, or similar storage device.

[0032]   System 100 allows handheld 110 to synchronize directly with server 130, over the internet, serial connection dial-up, Ethernet, infrared wireless, or other similar network, including enterprise data having multiple relationships. The present system and method resolves conflicts between server 130 and handheld 110 that occur during synchronization. The present techniques ensure synchronized data is reliable on both handheld 110 and server 130.

[0033]   **Figures 2A** and **2B** illustrate an exemplary flow diagram of the data exchange between handheld 110 and server 130 via web engine 120 for direct server 130 synchronization. The process begins at start block 200. At processing block 201 handheld 110 logs-in to server 130. Logging-in may be initiated by the user selecting a synchronization button on handheld 110. At decision block 202, server 130 confirms that handheld is allowed access to server 130. If the login is not valid, then flow ends at stop block 299. If the login is valid, flow continues to processing block 203.

[0034]   Handheld 110 retrieves a synchronization identifier (Sync ID) from server 130, at block 203. The sync ID is a unique identifier assigned to handheld 110. No two devices across the enterprise will have the same sync ID. The sync ID is never reused, reassigned, or recycled. Finally, the sync ID is stored on handheld 110. Flow continues to processing block 204.

[0035]   Handheld 110 requests and retrieves a repository version number or code from server 130. The repository version allows handheld 110 to determine if it needs to

synchronize by comparing the repository version with a locally stored repository version retrieved from its previous sync session. At processing block 205, handheld 110 retrieves views from server 130. A view is a special display of data, created as needed. A view temporarily ties two or more files together so that the combined files can be displayed, printed or queried. All accessible views and default views for the user of handheld 110 are retrieved.

[0036]   Default views specify views in an application to be synchronized and transferred to handheld 110. Applications running on handheld 110 may share common application definitions with those running on other platforms, such as desktops and laptops. Default views provide a way to limit the volume of data transferred to handheld 110.

[0037]   Furthermore, default views specify all the views that server 130 will extract from database 140 and download and synchronize with handheld 110. Each view has one business object associated with it. Each view may have a number of applets and each applet has a business component associated with it.

[0038]   Accessible views specify the views that a particular user account can see. It is controlled by responsibilities (a processing step performed by an object). Each user account can have one or more responsibilities. And each responsibility has a number of assigned views, which can be configured by an application. The accessible view list further limits the views a handheld 110.

[0039]   Default Business Object lists specify all the extra data used by handheld 110 at the application level and/or special customization of business logics at the business component level.

[0040]   PDQ views result from PDQs that serve as synchronization filters to limit the volume of data transferred to handheld 110. PDQs are defined by a system administrator.

[0041]   Flow continues to processing block 206 where handheld 110 retrieves a list of business objects from server 130. If any objects in the list are missing from handheld 110, they are retrieved from server 130.

[0042]   At processing block 207, handheld 110 retrieves a list of previous transactions from server 130. The previous transactions list lists the transactions previously synchronized on handheld 110. Handheld 110 retrieves the list of previous transactions from server 130 to verify if server 130 in fact received it. Handheld 110 stores the list locally in case the local list is different from that retrieved from server 130. It implies that server 130 does not completely receive and handheld 110 should send the list of previous

transactions again to server 130. Afterwards, handheld 110 will retrieve the transactions from a local database, pack the transactions, and use them to replace the local list. This will be used in the next synchronization session and sent to server 130.

[0043]   With the list, handheld 110 may determine which transactions need to be processed. Flow continues to processing block 208, where server 130 processes any necessary transactions, determined in processing block 207. Each transaction is processed individually and a confirmation is sent to handheld 110 for each transaction, until all transactions are processed.

[0044]   At processing block 209, handheld 110 retrieves an event list from server 130. The event list allows handheld 110 to synchronized all events that occurred since the last synchronization with server 130. Flow continue to processing block 210 where handheld 110 retrieves the PDA repository from server 130. A repository upgrade and responsibility change may detected. If the repository is upgraded, a new PDA master repository is downloaded from handheld 110 to server 130. On server 130, the PDA repository will be regenerated based on the new PDA repository.

[0045]   At processing block 211, handheld 110 sets PDQs on server 130. Thus, once server 130 sends handheld 110 a confirmation, the PDQs are synchronized on both sides. Flow continues to processing block 212 where handheld 110 retrieves an extraction sequence ID from server 130. The extraction sequence ID allows handheld 110 know which database records need to be extracted form database 140 in order to be synchronized with server 130.

[0046]   Flow continues to processing block 213 where handheld 110 extracts necessary records from database 140 and returns a confirmation to server 130. At decision block 214, handheld 110 determines if the Extraction Sequence ID obtained at processing block 212 matches the previously obtained Extraction Sequence ID. If the Sequence IDs match, then flow continues to processing block 215. If the Sequence IDs do not match, then flow continues to processing block 216. At processing block 215 handheld 110 performs a "net" data extraction from Server 130. The net changes contain only the changes in database 140 since the last synchronization, which are relevant to handheld 110. A full data extraction from server 130 contains a snapshot of database 140, which is relevant to handheld 110. A full data extraction is retrieved at processing block 216.

[0047]   Flow continues to processing block 217, from both processing blocks 215 and 216, where handheld 110 completely rolls back transactions that occurred subsequent to the last synchronization.

[0048]   At processing block 218, handheld 110 imports the net changes downloaded to the device so that the local data model on sync client 111 reaches the same state as that of database 140.

[0049]   Flow continues to processing block 219 where handheld 110 logs off server 130 and the direct server sync process completes at stop block 299.

[0050]   All request are sent between handheld 110 and server 130 using HTTP. Parameters passed from handheld 110 so server 130 may use HTTP post parameters, such as username and pass word for logging-in, paced transactions, application names and sync filters.

[0051]   **Figure 3** illustrates a computer system 300 representing an integrated multi-processor, in which elements of the present invention may be implemented. For example, system 300 may be the architecture of server 130 or handheld 110. One embodiment of computer system 300 comprises a system bus 320 for communicating information, and a processor 310 coupled to bus 320 for processing information. Computer system 300 further comprises a random access memory (RAM) or other dynamic storage device 325 (referred to herein as main memory), coupled to bus 320 for storing information and instructions to be executed by processor 310. Main memory 325 also may be used for storing temporary variables or other intermediate information during execution of instructions by processor 310. Computer system 300 also may include a read only memory (ROM) and/or other static storage device 326 coupled to bus 320 for storing static information and instructions used by processor 310.

[0052]   A data storage device 327 such as a magnetic disk or optical disc and its corresponding drive may also be coupled to computer system 300 for storing information and instructions. Computer system 300 can also be coupled to a second I/O bus 350 via an I/O interface 330. A plurality of I/O devices may be coupled to I/O bus 350, including a display device 343, an input device (e.g., an alphanumeric input device 342 and/or a cursor control device 341).

[0053]   The communication device 340 is for accessing other computers (servers or clients) via a network. The communication device 340 may comprise a modem, a network interface card, or other well known interface device, such as those used for coupling to Ethernet, token ring, or other types of networks.

[0054]   A method and system for direct server synchronization with a handheld device is disclosed. Although the present invention has been described with respect to

specific examples and subsystems, it will be apparent to those of ordinary skill in the art that the invention is not limited to these specific examples or subsystems but extends to other embodiments as well. The present invention includes all of these other embodiments as specified in the claims that follow.

CLAIMS

We claim:

1). A method, comprising:

synchronizing directly a computing device and an enterprise server, comprising;

retrieving a record extraction sequence from the server; and

extracting records stored on a database according to the record extraction sequence, wherein the extracted records are not already stored on the computing device.

2). The method of claim 1, further comprising:

logging-in to the server from the computing device, wherein the computing device is a handheld device; and

retrieving a persistent node ID from the server for the handheld.

3). The method of claim 2, further comprising:

retrieving one or more views from the server that are not already on the handheld device; and

retrieving one or more business objects from the server that are not already on the handheld device.

4). The method of claim 3, further comprising:

processing transactions on the server; and

retrieving one or more events from the server that are not already on the handheld device.

5). The method of claim 4, further comprising:

retrieving a PDA repository associated with the handheld device from the server.

6). A method, comprising:

synchronizing directly a handheld device and an enterprise server, comprising;

providing a record extraction sequence to the handheld;

extracting records stored on a database according to the record extraction
sequence, wherein the extracted records are not already stored on the
handheld device; and

providing the records to the handheld device.

7).   The method of claim 6, further comprising:
verifying the handheld device has a valid logon ID; and
providing a persistent node ID to the handheld.

8).   The method of claim 7, further comprising:
providing one or more views to the handheld that are not already on the
handheld device; and

providing one or more business objects to the handheld that are not already on
the handheld device.

9).   The method of claim 8, further comprising:
processing transactions on the server; and
providing one or more events to the handheld that are not already on the
handheld device.

10).   The method of claim 9, further comprising:
providing a PDA repository associated with the handheld device to the handheld
device.

11).   A system, comprising:
means for synchronizing directly a handheld device and an enterprise server,
comprising;

means for retrieving a record extraction sequence from the server; and

means for extracting records stored on a database according to the record
extraction sequence, wherein the extracted records are not already stored on
the handheld device.

12).   The system of claim 11, further comprising:
means for logging-in to the server from the handheld; and

means for retrieving a persistent node ID from the server for the handheld.

13).   The system of claim 12, further comprising:
    means for retrieving one or more views from the server that are not already on
        the handheld device; and
    means for retrieving one or more business objects from the server that are not
        already on the handheld device.

14).   The system of claim 13, further comprising:
    means for processing transactions on the server; and
    means for retrieving one or more events from the server that are not already on
        the handheld device.

15).   The system of claim 14, further comprising:
    means for retrieving a PDA repository associated with the handheld device from
        the server.

16).   A system, comprising:
means for synchronizing directly a handheld device and an enterprise server,
        comprising;
    means for providing a record extraction sequence to the handheld;
    means for extracting records stored on a database according to the record
        extraction sequence, wherein the extracted records are not already stored on
        the handheld device; and
    means for providing the records to the handheld device.

17).   The system of claim 16, further comprising:
    means for verifying the handheld device has a valid logon ID; and
    means for providing a persistent node ID to the handheld.

18).   The system of claim 17, further comprising:
    means for providing one or more views to the handheld that are not already on
        the handheld device; and

means for providing one or more business objects to the handheld that are not
already on the handheld device.

19).   The system of claim 18, further comprising:
means for processing transactions on the server; and
means for providing one or more events to the handheld that are not already on
the handheld device.

20).   The system of claim 19, further comprising:
means for providing a PDA repository associated with the handheld device to the
handheld device.

21).   A computer-readable medium having stored thereon a plurality of
instructions, said plurality of instructions when executed by a computer, cause said
computer to perform:
synchronizing directly a handheld device and an enterprise server, comprising;
retrieving a record extraction sequence from the server; and
extracting records stored on a database according to the record extraction
sequence, wherein the extracted records are not already stored on the
handheld device.

22).   The computer-readable medium of claim 21 having stored thereon additional
instructions, said additional instructions when executed by a computer, cause said computer
to further perform:
logging-in to the server from the handheld; and
retrieving a persistent node ID from the server for the handheld.

23).   The computer-readable medium of claim 22 having stored thereon additional
instructions, said additional instructions when executed by a computer, cause said computer
to further perform:
retrieving one or more views from the server that are not already on the
handheld device; and
retrieving one or more business objects from the server that are not already on
the handheld device.

24).   The computer-readable medium of claim 23 having stored thereon additional instructions, said additional instructions when executed by a computer, cause said computer to further perform:

> processing transactions on the server; and
>
> retrieving one or more events from the server that are not already on the
>> handheld device.

25).   The computer-readable medium of claim 24 having stored thereon additional instructions, said additional instructions when executed by a computer, cause said computer to further perform,

> retrieving a PDA repository associated with the handheld device from the server.

26).   A computer-readable medium having stored thereon a plurality of instructions, said plurality of instructions when executed by a computer, cause said computer to perform:

synchronizing directly a handheld device and an enterprise server, comprising;
> providing a record extraction sequence to the handheld;
> extracting records stored on a database according to the record extraction
>> sequence, wherein the extracted records are not already stored on the
>> handheld device; and
> providing the records to the handheld device.

27).   The computer-readable medium of claim 26 having stored thereon additional instructions, said additional instructions when executed by a computer, cause said computer to further perform:

> verifying the handheld device has a valid logon ID; and
> providing a persistent node ID to the handheld.

28).   The computer-readable medium of claim 27 having stored thereon additional instructions, said additional instructions when executed by a computer, cause said computer to further perform:

> providing one or more views to the handheld that are not already on the
>> handheld device; and

providing one or more business objects to the handheld that are not already on
the handheld device.

29).   The computer-readable medium of claim 28 having stored thereon additional
instructions, said additional instructions when executed by a computer, cause
said computer to further perform:

processing transactions on the server; and

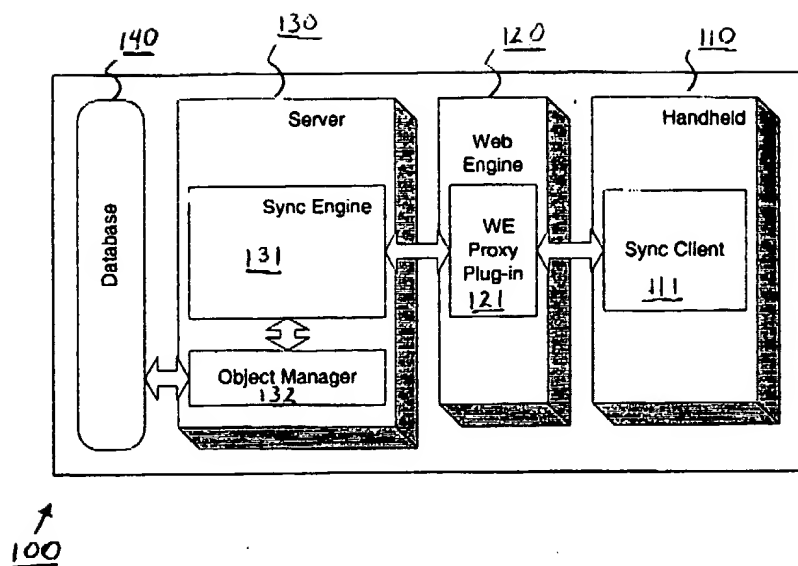providing one or more events to the handheld that are not already on the
handheld device.

30).   The computer-readable medium of claim 29 having stored thereon additional
instructions, said additional instructions when executed by a computer, cause said computer
to further perform,
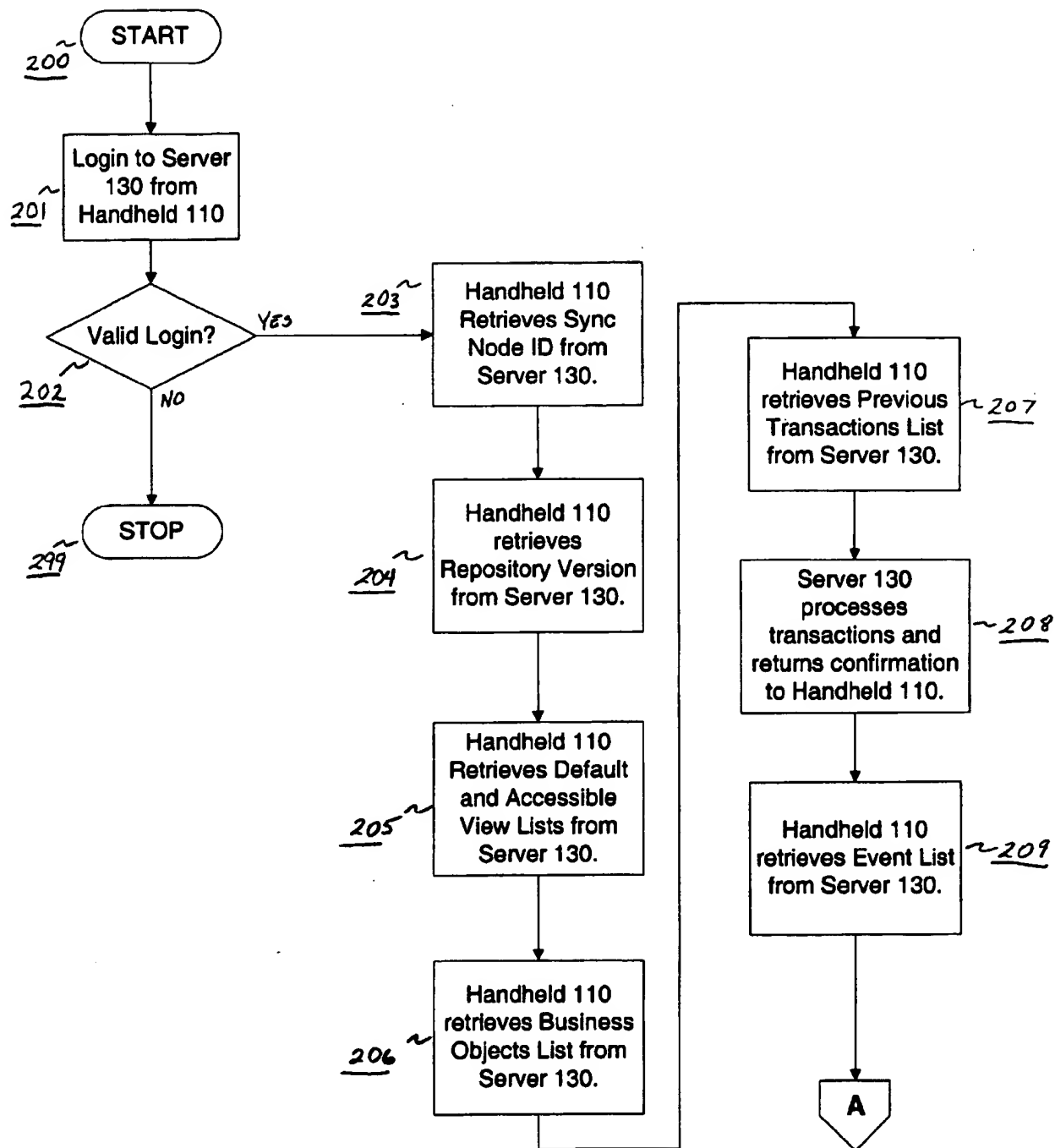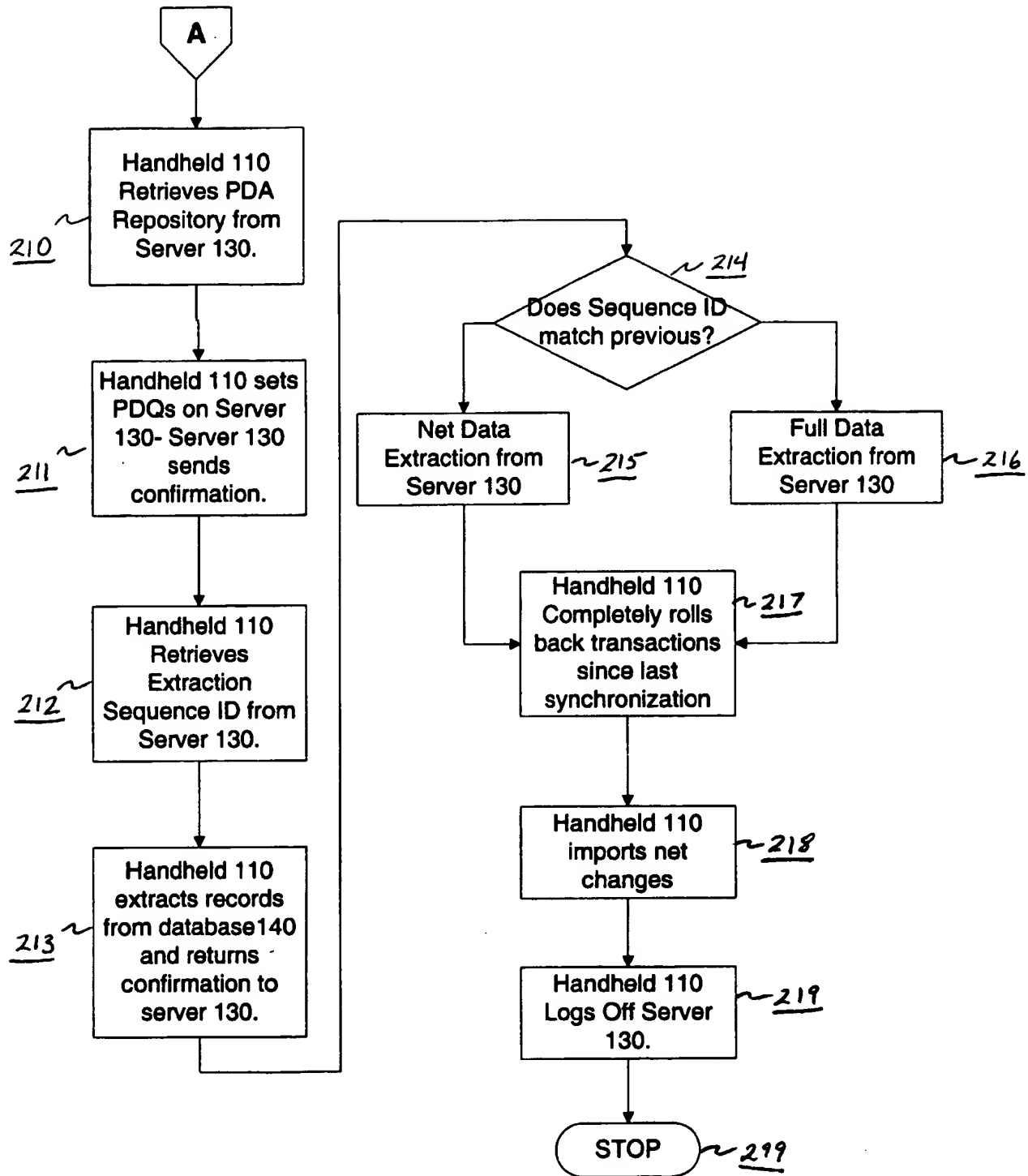
providing a PDA repository associated with the handheld device to the handheld
device.

FIGURE 1

START

200

Login to Server
130 from
Handheld 110

201

Valid Login?

202

NO

YES

203

Handheld 110
Retrieves Sync
Node ID from
Server 130.

STOP

299

204

Handheld 110
retrieves
Repository Version
from Server 130.

205

Handheld 110
Retrieves Default
and Accessible
View Lists from
Server 130.

206

Handheld 110
retrieves Business
Objects List from
Server 130.

207

Handheld 110
retrieves Previous
Transactions List
from Server 130.

208

Server 130
processes
transactions and
returns confirmation
to Handheld 110.

209

Handheld 110
retrieves Event List
from Server 130.

A

Figure 2A

A

Handheld 110
Retrieves PDA
Repository from
Server 130.
210

Handheld 110 sets
PDQs on Server
130- Server 130
sends
confirmation.
211

Handheld 110
Retrieves
Extraction
Sequence ID from
Server 130.
212

Handheld 110
extracts records
from database140
and returns
confirmation to
server 130.
213

214
Does Sequence ID
match previous?

Net Data
Extraction from
Server 130 *215*

Full Data
Extraction from
Server 130   *216*

Handheld 110
Completely rolls
back transactions
since last
synchronization *217*

Handheld 110
imports net
changes   *218*

Handheld 110
Logs Off Server
130.   *219*

STOP   *299*

Figure 2B

FIG. 3

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7)   :G06F 15/16
US CL   :709/242, 248, 253; 707/500.1, 200, 10, 103R
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. :   709/242, 248, 253; 707/500.1, 200, 10, 103R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST, INTERNET, NPL
search terms: database, repository, synchronize, update, handheld, pda, mobile, server, client, records

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,205,448 A (KRUGLIKOV et al) 20 MARCH 2001, ABSTRACT, FIGURES 1, 5A, 6, 7, 8,10, COL. 2, LINES 1-67, COL. 3, LINES 1-67, COL. 4, LINES 1-67, COL. 5, LINES 1-67, COL. 6, LINES 1-25.	1-30
Y	US 5,857,201 A (WRIGHT, JR. et al) 05 JANUARY 1999, ABSTRACT, FIGURES 1, 2, 4A, COL. 2, LINES 23-59, COL. 3, LINES 5-27, COL. 4, LINES 1-67, COL. 5, LINES 1-67.	1-30
Y	US 5,867,688 A (SIMMON et al) 02 FEBRUARY 1999, ABSTRACT, COL. 2, LINES 25-58, COL. 3, LINES 1-67, COL. 4, LINES 1-44.	1-30

☒ Further documents are listed in the continuation of Box C.   ☐   See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O"	document referring to an oral disclosure, use, exhibition or other means		
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Date of the actual completion of the international search	Date of mailing of the international search report
06 MAY 2002	**31 MAY 2002**

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,991,771 A (FALLS et al) 23 NOVEMBER 1999, ABSTRACT, COLL 3, LINES 15-65, COL 4, LINES 1-67, COL 5, LINES 1-67, COL 6, LINES 44-67.	1-30
Y	US 5,640,566 A (VICTOR et al) 17 JUNE 1997, ABSTRACT, COL 1, LINES 1-67, COL 2, LINES 1-26.	1-30
Y, P	US 6,269,369 B1 (ROBERTSON) 31 JULY 2001, ABSTRACT, COL 1, LINES 4-67, COL 2, LINES 1-67, COL 3, LINES 1-30, COL 4, LINES 18-67, COL 5, LINES 1-67.	1-30